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EFFICACY OF UPH 210 B AGAINST WEEDS IN TRANSPLANTED PADDY

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ABSTRACT

A field study was conducted on efficacy of herbicides against weeds in transplanted rice during Kharif 2015 and summer 2016 at Agricultural Research Station, Dhadesugur, University of Agricultural Sciences, Raichur, Karnataka, India. The weeds, which were dominant in trials field are Echinochloa sp. Panicum repens, Cynodon dactylon and Leptochloa chinensis among grasses, Eclipta alba and Ludwigia parviflora as broad leaf weeds and Cyperus sp. as sedge. Results revealed that, significantly higher grain yield of rice was recorded in weed management treatments over weedy check. However, among weed management herbicidal treatments, pre-emergent application of UPH 210b @ 2500 ml/ha was at par with its lower dose i.e. application of UPH 210b @ 2000 ml/ha, found to be significantly superior and on par with recorded higher grain yield followed by twice hand weeding at 15 and 30 days after transplanting. Moreover, maximum cost benefit ratio was observed in plots treated with UPH 210b along with twice hand weeded check

KEYWORDS: Dry Weight of Weeds, Weed Control Efficiency, Grain Yield & UPH 210 B

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Original Article

INTRODUCTION

Rice has been staple food for more than 60 per cent of the world population, providing energy for about 40% of the world population where every third person on earth consumes rice every day in one form or other **(Datta and Khushi, 2002).** Therefore, crop paddy (*Oryza sativa* L.) is an important crop which is extensively grown in tropical and subtropical regions of the world. There are several reasons for its low productivity but the losses due to weeds are one of the most important. More than one third of the total loss (33%) is caused by weeds alone (**Verma *et al.*, 2015**). Weeds are most severe and widespread biological constraints to crop production in India. Weeds are responsible for heavy yield losses in paddy, to the extent of complete crop failure under severe infestation conditions. Irrespective of the method of paddy establishment, weeds are a major impediment to paddy production due to their ability to compete for resources. In general, weeds problem in transplanted paddy is lower than that of direct seeded paddy because of puddling and stagnation of water in transplanted paddy during early growth stage of crop. But in some cases where continuous standing water cannot be maintained particularly for the first 45 days, weed infestation in transplanted paddy also may be as high as direct seeded paddy. According to **Singh *et al.* (2004)** weeds can reduce the grain yield of dry-seeded paddy (DSR) by 75.8%, wet seeded paddy (WSR) by 70.6% and transplanted paddy (TPR) by 62.6%. Weeds by virtue of their high adaptability and faster growth dominate the crop habitat and reduce the yield potential. Therefore, the present investigation was undertaken to study the effect of pre-emergent herbicide for control of major weeds in transplanted rice.

MATERIAL AND METHODS

A field study was taken during *Kharif*-2015 and *Summer*-2016 on effect of different herbicides against weeds in transplanted rice at Agricultural Research Station, Dhadesugur. The soil of the experimental site was medium deep black and neutral in pH (8.04), EC (0.47 ds/m), medium in organic carbon content (0.41%), low in nitrogen (189 kg/ha), medium in phosphorus (58.5 kg/ha) and potassium (287.5 kg/ha). There are eight treatments *viz*., **T_1:** UPH 210b @ 1500 ml/ha, **T_2:** UPH 210b @ 2000 ml/ha, **T_3:** UPH 210b @ 2500 ml/ha, **T_4:** Pendimethalin 30% EC @ 5000ml /ha, **T_5:** Pyrazosulfuron ethyl 10% WP @ 150 g /ha, **T_6:** Pyrazosulfuron ethyl 10% WP @ 200 g/ha, **T_7:** Metsulfuron methyl 10% + Chlorimuron ethyl 10% WP @ 20g/ha, **T_8:**Hand weeding and **T_9:** Weedy check and replicated thrice. Herbicides were sprayed using a Knapsack sprayer fitted with a flat nozzle at a spray volume of 500 l/ha. 25 days old seedlings were transplanted at a spacing of 20 cm x 15 cm in both the years. Recommended dose of fertilizer (150:75:75 kg NPK/ha) was applied uniformly in three equal splits. Irrigation comprised of continuous flooding followed by intermittent irrigation at three days interval up to 15 days before harvest. Other agronomic and plant protection measures were adopted as recommended during the crop growth. The efficacy of different treatments on weeds was evaluated at crop maturity. Quadrates (0.25 m^2) were placed in each plot at random to determine the weed density. Weed seedlings within these quadrates were counted and the efficacy of weed control treatments was evaluated by comparing the density with the untreated control. Weeds were cut at ground level, washed with tap water, oven dried at 70^0C for 48 hours and then weighed for dry matter. The weed control efficiency was calculated using the formula as follows **(Tawaha *et al*. 2002).**

Weed Control Efficiency (WCE) =	Dry weight of weeds under control plot – Dry weight of weeds under treatments	X 100
	Dry weight of weeds under control plot)	

After harvest and threshing of crop, grain yield was recorded in net plot wise and converted to grain yield per hectare basis. The cost of inputs that were prevailing at the time of their use was considered for working out the economics of various treatments. Net return per hectare was calculated by deducting the cost of cultivation from gross returns per hectare, gross returns was calculated by using the total income obtained from grain and straw yield of rice and the benefit cost ratio was worked out as follows.

Benefit Cost Ratio =	Gross returns (`/ha)
	Cost of cultivation (`/ ha)

To see the impact of these herbicide on succeeding crop, the black gram crops was sown after harvesting of the paddy crop from the herbicide treated plots and the data recorded on germination of seed and impact on crop growth and development *viz*. Leaf injury on tips and Leaf surface, Wilting, Vein clearing, Necrosis, Epinasty, Hyponasty, stunted growth *etc*. after 7, 15 and 21 days after germination (DAG). The data from in each year analysed separately. MSTAT was used for statistical analysis of data and means were separated using critical difference (CD) at p=0.05. The data on weeds were transformed by square root transformation before being subjected to ANOVA **(Gomez and Gomez, 1984).**

RESULTS AND DISCUSSIONS

Effect on Weed Density

Grassy weeds: The data on weed density is presented in **Table 1 & 2.** Results revealed that, all the weed management treatments significantly reduced grassy weeds populations as compared to Metsulfuron methyl 10% + Chlorimuron ethyl 10% WP @ 20 g/ha and weedy check in *Kharif* 2015 when observed at 30 days after transplanting.

Among the herbicidal treatments, pre-emergent application of UPH 210b @ 2500 ml/ha was on par with UPH 210b @ 2000 ml/ha and twice hand weeded check, found to be significantly superior treatment with recorded lowest population of grassy weeds i.e. *Echinochloa spp. (E. colona, E. crusgalli), Panicum repens*, *Elusine indica* and *Leptochloa chinensis* at 30 days after transplanting. Pre-emergent application of UPH 210b @ 1500 ml/ha was the next treatment in terms of controlling grassy weeds after Pyrazosulfuron ethyl 10% WP @ 150 g/ha and 200 g/ha. Similar trend was observed in *Summer* 2016 when observed at 30 days after transplanting where pre-emergent application of UPH 210b @ 2500 ml/ha was on par with the application of UPH 210b @ 2000 ml/ha and twice hand weeded check, found to be significantly superior treatment with recorded lowest population of grassy weeds.

Broad Leaf Weeds

The data on density of broad leaf weeds recorded in *Kharif* 2015 and *Summer* 2016 at 30 days after transplanting are mentioned in **Table 1 & 2**. Results revealed that, in weed management treatments, pre-emergent application of UPH 210b @ 2500 ml/ha, 2000 ml/ha, and twice hand weeded check were found superior over the application of UPH 210b @ 1500 ml/ha and rest of the treatments. However, application of Pyrazosulfuron ethyl 10% WP @ 150 g/ha, 200 g/ha and Metsulfuron methyl 10% + Chlorimuron ethyl 10% WP @ 20 g/ha were on par with each other. Similar trend was observed in *Summer* 2016 when observed at 30 days after transplanting, where, pre-emergent application of UPH 210b @ 2500 ml/ha was on par with the application of UPH 210b @ 2000 ml/ha and twice hand weeded check, found to be significantly superior treatment with recorded lowest population of broad leaf weeds.

Sedges

Results revealed that, in weed management treatments, pre-emergent application of UPH 210b @ 2500 ml/ha, 2000 ml/ha and twice hand weeded check were found superior over UPH 210b @ 1500 ml/ha and rest of the treatments. However, application of Pyrazosulfuron ethyl 10% WP @ 150 g/ha, 200 g/ha and Metsulfuron methyl 10% + Chlorimuron ethyl 10% WP @ 20 g/ha were on par with each other in controlling the sedges in transplanted paddy. Similar trend was observed in *Summer* 2016 as mentioned in **Table 1 & 2** when observed at 30 days after transplanting, where, pre-emergent application of UPH 210b @ 2500 ml/ha was on par with the application of UPH 210b @ 2000 ml/ha and twice hand weeded check, found to be significantly superior treatment with recorded lowest population of sedges weeds.

Effect on Dry Weight of Weeds

The data on weed dry weight is presented in **Table 3 & 4.** Results revealed that, all the weed management treatments significantly reduced total dry weight of weeds as compared to weedy check in *Kharif* 2015 when observed at 30 days after transplanting. Among the herbicidal treatments, pre-emergent application of UPH 210b @ 2500 ml/ha, 2000 ml/ha and twice hand weeded check, found to be significantly superior over the application of UPH 210b @ 1500 ml/ha and rest of the treatments except the application of Metsulfuron methyl 10% + Chlorimuron ethyl 10% WP @ 20 g/ha. Pre-emergent application of UPH 210b @ 2000, 2500 ml/ha and Pendimethalin 30% EC @ 1500 ml/ha were recorded least dry weight of weeds. Similar trend was observed in *Summer* 2016 when observed at 30 days after transplanting where the pre-emergent application of UPH 210b @ 2500 ml/ha was on par with the application of UPH 210b @ 2000 ml/ha and twice hand weeded check, found to be significantly superior treatment with recorded lowest dry weight of weeds. **Angiras and Kumar (2005)** also found that broadcast application of pyrazosulfuron-ethyl at 15 g/ha mixed with sand at 150 kg/ha was effective to control weeds in rice which resulted in significantly lower weed density and biomass without any

phytotoxic effect on rice plant. Pyrazosulfuron-ethyl at 20 and 25 g/ha significantly reduced weed density and total weed biomass of *Cyperus iria, Echinochloa colona etc.* when applied at 3 to 10 days after transplanting **(Chopra and Chopra 2003).**

Effect on Weed Control Efficiency (WCE)

Results revealed that, all the weed management treatments significantly recorded higher weed control efficiency compared to weedy check in *Kharif* 2015 when observed at 30 days after transplanting. Among the herbicidal treatments, pre-emergent application of UPH 210b @ 2500 ml/ha, 2000 ml/ha and twice hand weeded check, found to be significantly superior over the application of UPH 210b @ 1500 ml/ha and rest of the treatments except the application of Metsulfuron methyl 10% + Chlorimuron ethyl 10% WP @ 20 g/ha. Pre-emergent application of UPH 210b @ 2000, 2500 ml/ha and Pendimethalin 30% EC @ 1500 ml/ha were recorded least weed control efficiency. Similar trend was observed in *Summer* 2016 when observed at 30 days after transplanting where the pre-emergent application of UPH 210b @ 2500 ml/ha was on par with the application of UPH 210b @ 2000 ml/ha and twice hand weeded check, found to be significantly superior treatment with recorded lowest weed control efficiency (**Table 3 & 4)**. Similar results were also noticed by **Rathour *et al.* 2015.**

Effect on Yield and Economics

Significantly higher grain yield of rice was recorded in weed management treatments over weedy check. However, among weed management herbicidal treatments, pre-emergent application of UPH 210b @ 2500 ml/ha was at par with its lower dose i.e. application of UPH 210b @ 2000 ml/ha, found to be significantly superior and on par with recorded higher grain yield followed by twice hand weeding at 15 and 30 days after transplanting. Moreover, maximum cost benefit ratio was observed in plots treated with UPH 210b along with twice hand weeded check **(Table 5).** These results are conformity with the findings of **Kamdi *et al.* 2014 and Prasad *et al.* 2014)**

Effect of Herbicides on Succeeding Blackgram Crop

The phytotoxicity effect on succeeding black gram in terms of leaf necrosis, chlorosis or wilting was observed at 7, 15 and 21 days after germination (DAG) at different dosages of UPH 210b including untreated control. Results indicated that, there was no phytotoxicity effect (rating 0) noticed in all the plots **(Table 6)** in both the season. Further there was no impact on germination of black gram seed which was sown after harvesting of paddy crop from the herbicides treated plot in both the season.

CONCLUSIONS

Results indicated that, UPH 210b @ 2500 g/ha could be recommended for pre-emergence application at 3 days after transplanting of paddy crop to achieve effective control of : *Echinichloa sp. Panicum repens, Elusine indica* and *Leptochloa chinensis* among grasses *Eclipta alba* and *Ludwigia parviflora* as broad leaf weeds and *Cyperus sp.* as sedge weeds and produces higher grain yield of paddy.

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APPENDICES

Table 1: Effect of Weed Control Treatments on Weed Population (Count/m^2) in Transplanted Paddy at 30 Days after Transplanting (Kharif 2015)

Treatments	Grasses				Broad Leaf Weeds		*Sedges*
	Echinichloa Sp.	***Panicum Repens***	***Elusine Indica***	***Leptochloa Chinensis***	***Eclipta Alba***	***Ludwigia Parviflora***	***Cyperus Sp.***
T_1: UPH 210b @ 1500 ml/ha	1.67* (1.63)	1.33 (1.52)	1.33 (1.52)	1.33 (1.52)	1.33 (1.52)	2.00 (1.72)	2.00 (1.72)
T_2: UPH 210b @ 2000 ml/ha	0.33 (1.14)	0.00 (1.00)	0.33 (1.14)	0.33 (1.14)	0.33 (1.14)	0.33 (1.14)	0.67 (1.28)
T_3: UPH 210b @ 2500 ml/ha	0.00 (1.00)	0.00 (1.00)	0.33 (1.14)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)
T_4: Pendimethalin 30% EC @ 5000ml /ha	1.33 (1.52)	1.67 (1.61)	1.67 (1.63)	1.33 (1.52)	2.67 (1.90)	3.67 (2.16)	3.67 (2.14)
T_5: Pyrazosulfuron ethyl 10% WP @ 150 g /ha	3.67 (2.16)	3.00 (1.99)	2.67 (1.90)	2.67 (1.88)	1.33 (1.52)	1.67 (1.63)	1.33 (1.52)
T_6: Pyrazosulfuron ethyl 10% WP @ 200 g/ha	4.00 (2.23)	3.33 (2.07)	3.00 (1.99)	3.00 (1.99)	1.00 (1.41)	1.33 (1.47)	1.00 (1.38)
T_7: Metsulfuron methyl 10% + Chlorimuron ethyl 10% WP @ 20g/ha	11.67 (3.54)	14.00 (3.87)	13.67 (3.81)	13.00 (3.73)	1.00 (1.41)	1.00 (1.41)	1.33 (1.52)
T_8: Hand weeding	0.67 (1.28)	0.67 (1.28)	0.67 (1.28)	0.33 (1.14)	0.33 (1.14)	0.33 1.14 ( )	0.67 (1.28)
T_9: Weedy check	16.33 (4.15)	15.67 (4.07)	15.33 (4.03)	15.67 (4.07)	14.67 (3.95)	14.00 (3.87)	14.67 (3.95)
CD at 5%	**0.45**	**0.35**	**0.36**	**0.35**	**0.31**	**0.42**	**0.40**

Note: Figures in the parenthesis are square root transformed values (sq. root of x+1)

Table 2: Effect of Weed Control Treatments on Weed Population (Count/M^2) in Transplanted Paddy at 30 Days after Transplanting (Summer 2016)

Treatment	Grasses				Broad Leaf Weeds		*Sedges*
	Echinichloa sp.	*Panicum repens*	*Elusine Indica*	*Leptochloa chinensis*	*Eclipta alba*	*Ludwigia parviflora*	*Cyperus sp.*
T_1: UPH 210b @ 1500 ml/ha	4.30*	2.00	3.30	5.30	3.00	2.67	2.33
	(2.30)	(1.73)	(2.07)	(2.51)	(2.00)	(1.92)	(1.82)
T_2: UPH 210b @ 2000 ml/ha	1.00	0.67	1.00	1.30	1.00	1.33	1.00
	(1.41)	(1.29)	(1.41)	(1.52)	(1.41)	(1.53)	(1.41)
T_3: UPH 210b @ 2500 ml/ha	0.67	0.33	0.67	1.67	0.67	1.00	1.33
	(1.29)	(1.15)	(1.29)	(1.63)	(1.29)	(1.41)	(1.53)
T_4: Pendimethalin 30% EC @ 5000 ml /ha	2.67	1.67	3.00	3.67	5.33	5.33	4.33
	(1.92)	(1.63)	(2.00)	(2.16)	(2.52)	(2.52)	(2.31)
T_5: Pyrazosulfuron ethyl 10% WP @ 150 g /ha	7.33	7.33	5.67	8.67	2.33	2.33	2.67
	(2.89)	(2.89)	(2.58)	(3.11)	(1.82)	(1.82)	(1.92)
T_6: Pyrazosulfuron ethyl 10% WP @ 200 g/ha	7.67	7.00	6.67	7.00	2.00	2.67	2.00
	(2.94)	(2.83)	(2.77)	(2.83)	(1.73)	(1.92)	(1.73)
T_7: Metsulfuron methyl 10% + Chlorimuron ethyl 10% WP @ 20g/ha	18.30	8.33	6.00	13.00	2.67	2.33	2.33
	(4.39)	(3.05)	(2.65)	(3.74)	(1.92)	(1.82)	(1.82)
T_8: Hand weeding	1.00	0.33	0.00	1.00	1.00	1.00	1.00
	(1.41)	(1.15)	(1.00)	(1.41)	(1.41)	(1.41)	(1.41)
T_9: Weedy check	17.67	7.67	6.30	12.67	14.33	13.67	8.33
	(4.32)	(2.94)	(2.70)	(3.70)	(3.92)	(3.83)	(3.05)
CD at 5%	**0.43**	**0.46**	**0.46**	**0.39**	**0.48**	**0.51**	**0.41**

Note: Figures in the parenthesis are square root transformed values (sq. root of x+1)

Table 3: Weeds Dry Weights (G/M^2) in Transplanted Rice at 30 Days after Transplanting (Kharif 2015)

Treatments	Weed dry weight (g/m^2)				
	Grasses	BLW	Sedges	Total	WCE (%)
T_1: UPH 210b @ 1500 ml/ha	4.50*	4.96	4.93	14.48	73.95
T_2: UPH 210b @ 2000 ml/ha	1.63	1.67	1.63	4.93	91.14
T_3: UPH 210b @ 2500 ml/ha	1.59	1.56	1.50	4.65	91.63
T_4: Pendimethalin 30% EC @ 5000 ml /ha	1.62	6.37	5.30	13.29	76.09
T_5: Pyrazosulfuron ethyl 10% WP @ 150 g/ha	5.86	4.74	4.60	15.20	72.65
T_6: Pyrazosulfuron ethyl 10% WP @ 200 g/ha	5.75	4.75	4.68	15.19	72.67
T_7: Metsulfuron methyl 10% + Chlorimuron ethyl 10% WP @ 20 g/ha	17.23	4.72	4.61	26.57	52.20
T_8: Hand weeding	1.64	1.71	1.61	4.96	91.07
T_9: Weedy check	17.53	18.94	19.11	55.58	-
CD at 5%	**1.25**	**1.31**	**2.43**	**3.55**	

Table 4: Weeds Dry Weights (G/M^2) in Transplanted Rice at 45 Days after Transplanting (Summer 2016)

Treatments	Weed dry weight (g/m^2)				
	Grasses	BLW	Sedges	Total	WCE (%)
T_1: UPH 210b @ 1500 ml/ha	6.5	3.60	3.90	14.00	69.05
T_2: UPH 210b @ 2000 ml/ha	1.83	1.45	2.01	5.29	88.30
T_3: UPH 210b @ 2500 ml/ha	1.80	1.40	1.85	5.05	88.83
T_4: Pendimethalin 30% EC @ 5000ml /ha	3.62	5.80	16.30	25.72	43.14
T_5: Pyrazosulfuron ethyl 10% WP @ 150 g /ha	8.50	2.67	16.80	27.97	38.16
T_6: Pyrazosulfuron ethyl 10% WP @ 200 g/ha	7.23	2.34	15.00	24.57	45.68

Table 4: Contd.,					
T_7: Metsulfuron methyl 10% + Chlorimuron ethyl 10% WP @ 20g/ha	19.50	3.12	4.33	26.95	40.42
T_8: Hand weeding	1.23	1.16	2.22	4.61	89.81
T_9: Weedy check	16.50	12.43	16.30	45.23	-
CD at 5%	**1.78**	**1.60**	**1.82**	**3.44**	-

Table 5: Effect on Grain Yield and Economics of Transplanted Rice (Kharif 2015)

Treatments	Grain Yield (q/ha)	C:B ratio		
	2015	2016	2015	2016
T_1: UPH 210b @ 1500 ml/ha	57.38	52.3	1:5.9	1:6.3
T_2: UPH 210b @ 2000 ml/ha	60.88	58.12	1:7.4	1:9.4
T_3: UPH 210b @ 2500 ml/ha	62.48	58.9	1:7.0	1:8.1
T_4: Pendimethalin 30% EC @ 5000ml /ha	56.42	53.65	1:2.9	1:4.6
T_5: Pyrazosulfuron ethyl 10% WP @ 150 g /ha	53.61	48.52	1:5.4	1:7.0
T_6: Pyrazosulfuron ethyl 10% WP @ 200 g/ha	54.35	49.03	1:6.1	1:6.6
T_7: Metsulfuron methyl 10% + Chlorimuron ethyl 10% WP @ 20g/ha	53.49	47.78	1:6.3	1:5.5
T_8: Hand weeding	60.51	58.9	1:5.7	1:6.4
T_9: Weedy check	52.1	46.5	-	-
CD (P=0.05)	2.56	3.62	-	-

Table 6: Phytotoxicity and Germination Per Cent of Black Gram as the Application of Herbicides (Mean Data)

Treatments	Phytotoxic Effect (%)			Germination Percent
	7 DAG	15 DAG	21 DAG	
T_1: UPH 210b @ 1500 ml/ha	0.0	0.0	0.0	94.0
T_2: UPH 210b @ 2000 ml/ha	0.0	0.0	0.0	93.0
T_3: UPH 210b @ 2500 ml/ha	0.0	0.0	0.0	93.0
T_4: Pendimethalin 30% EC @ 5000ml /ha	0.0	0.0	0.0	92.0
T_5: Pyrazosulfuron ethyl 10% WP @ 150 g /ha	0.0	0.0	0.0	93.0
T_6: Pyrazosulfuron ethyl 10% WP @ 200 g/ha	0.0	0.0	0.0	93.5
T_7: Metsulfuron methyl 10% + Chlorimuron ethyl 10% WP @ 20g/ha	0.0	0.0	0.0	92.0
T_8 : Weedy check (Untreated)	0.0	0.0	0.0	95.1